WHAT IS CLAIMED IS:

1. A machine-implemented method for placing a plurality of particles, each having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the method comprising:

a) defining a central string, a space disposed about the central string, and N concentric subspaces disposed about the central string and within the space, each of the N subspaces corresponding to one of the N particle categories;

b) selecting a particle from the plurality of particles;

c) placing the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles,

the selected particle placement including defining a catch net representative of buoyancy of a portion of the placed particles and positioning the catch net within the space based upon the placement of the portion of the placed particles,

the selected particle placement further including defining a water level representative of a level of a portion of the placed particles that are smaller than the selected particle and represent a surface of the smaller placed particles, and positioning the water level within the space based upon the smaller particle surface,

the selected particle being placed in non-overlapping relation with respect to the catch net and the water level;

d) repeating the particle selection (b) and placement (c) until each of the particles of the plurality of particles has become one of the placed particles.

2. A machine-implemented method for placing a plurality of particles, each having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the method comprising:

a) defining a central string, a space disposed about the central string, and N concentric subspaces disposed about the central string and within the space, each of the N subspaces corresponding to one of the N particle categories;

b) selecting a particle from the plurality of particles;

c) placing the selected particle at a particle location unique to the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, the selected particle placement including defining a catch net representative of buoyancy of a portion of the placed particles and positioning the catch net within the space based upon the placement of the portion of the placed particles, the selected particle being placed in non-overlapping relation with respect to the catch net;

d) repeating the particle selection (b) and placement (c) until each of the particles of the plurality of particles has become one of the placed particles.

3. A method as recited in claim 2, wherein the particles comprise spheres and the characteristic dimension of each of the particles comprises a radius.

4. A method as recited in claim 2, wherein the particle selection comprises randomly selecting the selected particle from the plurality of particles.

5. A method as recited in claim 2, wherein:

the method further includes defining a pack surface for the placed particles; and

the catch net positioning comprises positioning the catch net relative to the pack surface.

6. A method as recited in claim 5, wherein the catch net positioning comprises positioning the catch net a distance from the pack surface based upon a selected particle radius.

7. A method as recited in clam 5, wherein:

the placed particles comprise a top layer; and

the pack surface comprises an average of the particle locations of the placed particles in the top layer.

8. A method as recited in claim 5, wherein:

each of the placed particles has a south pole located at a south pole position;

the placed particles comprise a top layer of the placed particles; and

the pack surface corresponds to the south poles of the top layer placed particles.

9. A method as recited in claim 8, wherein the particle surface corresponds to an average of the south pole positions of the top layer placed particles.

10. A method as recited in claim 2, wherein:

the space has a cross sectional area substantially perpendicular to the central string; and

the catch net extends across the cross sectional area of the space.

11. A method as recited in claim 2, wherein:

each of the subspaces has a cross sectional area substantially perpendicular to the central string; and

the catch net extends across the cross sectional areas of each of the subspaces.

12. A method as recited in claim 2, wherein:

each of the subspaces has a cross sectional area substantially perpendicular to the central string; and

the catch net comprises N subnets, one of the subnets corresponding to each of the subspaces.

13. A method as recited in claim 13, wherein each of the subnets extends over the cross sectional area of the corresponding subspace.

14. A method as recited in claim 13, wherein: each of the subnets has a level; and the levels of at least two of the subnets differ from one another.

15. A method as recited in claim 14, wherein the catch net positioning comprises setting each of the subnets at a selected distance from the top surface.

16. A method as recited in claim 2, wherein:

the space includes a base surface and the catch net positioning comprises spacing the catch net from the base surface.

17. A method as recited in claim 16, wherein the spacing from the base surface simulates a positioning of the catch net for a top layer of the placed particles.

18. A method as recited in claim 2, wherein:

the catch net positioning comprises assigning an initial catch net position for a kth one of the subspaces $Z_{init}(k)$; assigning as the characteristic dimension of the particles of a kth one of the particle categories a_k, assigning as the characteristic dimension of a small one of the particles a_{min} of the particles, and assigning as the characteristic dimension of a large one of the particles a_{max}; and

below a threshold level the catch net positioning further comprises positioning the catch net for a k_{th} one of the particle categories at a catch net position $Z_{net}(k)$ within a k_{th} one of the subspaces determined by

$Z_{net}(k) = Z_{init} + H\ r\ a_k\ a_{min}/a_{max}$

where r represents a weighting coefficient and H represents a switching coefficient.

19. A method as recited in claim 18, wherein the weighting coefficient is assigned a random number.

20. A method as recited in claim 18, wherein:

below the threshold value the switching coefficient is assigned a value of one; and

above the threshold value the switching coefficient is assigned a value of zero.

21. A method as recited in claim 5, wherein the pack surface defining comprises:

selecting a top layer of the placed particles;

for each particle category k of the placed particles in the top layer, defining a particle radius a_i for the placed particles i of that category k,

for the subspace k corresponding to the particle category k, assigning a cylinder radius W_k,

assigning a top layer particle number m(k) and determining values for m(k) by evaluating

$$\sum_{\substack{i=1 \\ Sub\,mode(i)\le k}}^{m(k)-1} a_i^2 < W_k^2 \le \sum_{\substack{i=1 \\ Sub\,mode(i)\le k}}^{m(k)} a_i^2 \ , \ k = 1, 2, ..., N$$

where N is the number of particle categories; and

determining the pack surface location using

$$S = \frac{1}{m}\sum_{i=1}^{m}(Z_i - a_i)$$

where S represents the pack surface and Z_i represents the position of a center of a center one of the placed spheres.

22. A method as recited in claim 5, wherein:

for a given particle category k and corresponding subspace k, the particle placement comprises contacting an i_{th} placed particle with the selected particle, the i_{th} placed particle having the characteristic dimension a_i and the selected particle having the characteristic dimension a_c;

the catch net comprises a subnet corresponding to the subspace k; and

if $a_i/a_c<1$, then the catch net positioning comprises positioning the subnet k for the k_{th} subspace $Z_{net}(k)$ at

$Z_{net}(k) = S - a_i$

where S represents the position of the pack surface.

23. A method as recited in claim 5, wherein:

for a given particle category k and corresponding subspace k, the particle placement comprises contacting an i_{th} placed particle with the selected particle, the ith placed particle having the characteristic dimension a_i and the selected particle having the characteristic dimension a_c;

the catch net comprises a subnet corresponding to the subspace k; and

if $1 \leq a_i/a_c < a_x$, where a_x represents a sample particle size for a corresponding sample particle that will fit into a cavity formed by placed spheres

larger than the sample particle, then the catch net positioning comprises positioning the subnet k for the kth subspace $Z_{net}(k)$ at

$Z_{net}(k) = S - 2a_c$

where S represents the position of the pack surface.

24. A method as recited in claim 23, wherein the sample particle size a_x is assigned a value of $\sqrt{6} + 2$.

25. A method as recited in claim 5, wherein:

for a given particle category k and corresponding subspace k, the particle placement comprises contacting an ith placed particle with the selected particle, the i_{th} placed particle having the characteristic dimension a_i and the selected particle having the characteristic dimension a_c;

the catch net comprises a subnet corresponding to the subspace k; and

if $a_i/a_c \geq a_x$, where a_x represents a sample particle size for a corresponding sample particle that will fit into a cavity formed by placed spheres larger than the sample particle, then the catch net positioning comprises positioning the subnet k for the kth subspace $Z_{net}(k)$ at

$Z_{net}(k) = S - 2a_c - a_i$

where S represents the position of the pack surface.

26. An apparatus for placing a plurality of particles, each particle having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of

the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the apparatus comprising:

a) an input device for inputting particle selection information,

b) a storage device operatively coupled to the input device for storing the particle selection information;

c) a processor for selecting a particle from the plurality of particles, for placing the selected particle at a particle location unique to the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, and for establishing a catch net representative of buoyancy of a portion of the placed particles and positioning the catch net within the space based upon the placement of the portion of the placed particles, the processor placing the selected particle being placed in non-overlapping relation with respect to the catch net.

27. A machine-readable medium for use in placing a plurality of particles, each particle having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the machine-readable medium comprising:

a) machine executable instructions for defining a central string, a space disposed about the central string, and N concentric subspaces disposed about the central string and within the space, each of the N subspaces corresponding to one of the N particle categories;

b) machine executable instructions for selecting a particle from the plurality of particles;

c) machine executable instructions for placing the selected particle at a particle location unique to the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, the selected particle placement instructions including instructions for defining a catch net representative of buoyancy of a portion of the placed particles and positioning the catch net within the space based upon the placement of the portion of the placed particles, the selected particle being placed in non-overlapping relation with respect to the catch net; and

d) machine executable instructions for repeating the particle selection (b) and placement (c) instructions until each of the particles of the plurality of particles has become one of the placed particles.

28. A machine-implemented method for placing a plurality of particles, each having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions

of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the method comprising:

a) defining a central string, a space disposed about the central string, and N concentric subspaces disposed about the central string and within the space, each of the N subspaces corresponding to one of the N particle categories;

b) selecting a particle from the plurality of particles;

c) placing the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, the selected particle placement including defining a water level representative of a level of a portion of the placed particles that are smaller than the selected particle and represent a surface of the smaller placed particles, and positioning the water level within the space based upon the smaller particle surface, the selected particle being placed in non-overlapping relation with respect to the water level;

d) repeating the particle selection (b) and placement (c) until each of the particles of the plurality of particles has become one of the placed particles.

29. A method as recited in claim 28, wherein the particles comprise spheres and the characteristic dimension of each of the particles comprises a radius.

30. A method as recited in claim 28, wherein:

the water level positioning comprises determining an average location of the particle locations along the central string of the particles of the portion of placed particles and positioning the water level at the average location.

31. A method as recited in claim 28, wherein:

the water level comprises a plurality of subspace water levels corresponding to a portion of the subspaces, each of the subspace water levels corresponding to one of the subspaces of the portion of subspaces; and

the water level positioning comprises assigning a subspace water level position to each of the subspace water levels.

32. A method as recited in claim 31, wherein:

each of the subspaces of the portion of subspaces comprises a subspace surface representative of the portion of the smaller placed particles within that subspace, each of the subspace surfaces comprising a subspace surface location with respect to the central string;

each of the placed particles comprises a north pole having a north pole location;

the subspace water level position for one of the subspaces i is in the portion of the subspaces determined by determining an average location of the north pole locations of the portion of the placed particles within the subspace i and assigning the average location as the subspace surface location for subspace i.

33. A method as recited in claim 31, wherein:

each of the subspaces of the portion of subspaces comprises a subspace surface representative of the portion of the smaller placed particles within that subspace, each of the subspace surfaces comprising a subspace surface location with respect to the central string;

each of the placed particles comprises a south pole having a south pole location;

the subspace water level position for one of the subspaces i is in the portion of the subspaces determined by determining an average location of the south pole locations of the portion of the placed particles within the subspace i and assigning the average location as the subspace surface location for subspace i.

34. A method as recited in claim 28, wherein:

the water level positioning comprises using an offset to position the water level.

35. A method as recited in claim 31, wherein:

the water level positioning comprises using an offset for each of the subspace water level positions.

36. An apparatus for placing a plurality of particles, each particle having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the apparatus comprising:

a) an input device for inputting particle selection information,

b) a storage device operatively coupled to the input device for storing the particle selection information;

c) a processor for selecting a particle from the plurality of particles, for placing the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, for establishing a water level representative of a level of a portion of the placed particles that are smaller than the selected particle and represent a surface of the smaller placed particles, and for positioning the water level within the space based upon the smaller particle surface, the selected particle being placed in non-overlapping relation with respect to the water level.

37. A machine-readable medium for use in placing a plurality of particles, each particle having a characteristic dimension, to create a particle pack, the plurality of particles comprising N categories of the particles, the characteristic dimension of the particles of a given category being different from the characteristic dimensions of the particles of other ones of the categories, the characteristic dimension of the particles increasing as the category N increases, the machine-readable medium comprising:

a) machine executable instructions for defining a central string, a space disposed about the central string, and N concentric subspaces disposed about the central string and within the space, each of the N subspaces corresponding to one of the N particle categories;

b) machine executable instructions for selecting a particle from the plurality of particles;

c) machine executable instructions for placing the selected particle at a particle location unique to the selected particle in the corresponding subspace so that the selected particle becomes a placed particle at a particle location unique to that placed particle and is in non-overlapping relation with other placed particles, the selected particle placement instructions including instructions for defining a water level representative of a level of a portion of the placed particles that are smaller than the selected particle and represent a surface of the smaller placed particles, and positioning the water level within the space based upon the smaller particle surface, the selected particle being placed in non-overlapping relation with respect to the water level; and

d) machine executable instructions for repeating the particle selection (b) and placement (c) instructions until each of the particles of the plurality of particles has become one of the placed particles.